

belongs to *N. sylvatica* Marshall. It is no doubt identical with *N. montana* hort. ex Pursh cited in Index Kewensis, but not with *N. montana* Gaertner which is referred to *N. ogeche*.

32. *Nyssa aquatica* is apparently the *Nyssa biflora* Walter of Michaux's Flora (II. 259).

33. *Nyssa dentata* is probably referable to *N. aquatica* L. which has more often dentate leaves than any of the other species. The name does not appear in Index Kewensis.

34. *Nyssa tomentosa* is apparently not the *N. tomentosa* of Michaux's Flora which is *N. aquatica* Marshall, but the *N. candicans* of Michaux's Flora (II. 259) which is the same as *N. tomentosa* Poiret and the *N. ogeche* Marshall. In both places, under *N. tomentosa* in the Journal and under *N. candicans* in the Flora the word "Ogechee" appears and in the description the words "foliis . . . incanis" in one place and "foliis . . . subcandicantibus" in the other indicate the identity.

THE RED RIVER FOREST AT FULTON, ARKANSAS

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IN the course of botanical explorations conducted by the Arnold Arboretum in the southern and southwestern states several localities have been found so remarkable for the richness and variety of their ligneous flora as to appear worthy of brief description. These silvan centers or natural arboretums, as they may almost be termed, usually occur, as might be expected, in places where a considerable diversity of soil, moisture, drainage, light and other ecological conditions prevail within narrow limits. In addition to affording unusual opportunities for the observation and collection of a variety of trees and shrubs, some of them comparatively rare or growing beyond the limits of their generally recognized range, such localities are of especial interest as compact fields for the study of natural forest conditions in their various phases and for the evidence they furnish or suggest regarding certain changes that have occurred or are in progress in the composition and distribution of the plants of our forest flora.

About great trees and ancient forests there is something sublime and inspiring that appeals to all fine natures. In the silence and shadows of the great woods one instinctively feels a sense of tranquillity and seclusion from the busy world. There is a suggestion too of permanence and stability and quiet dignity. These values for us are real, but if we probe a little deeper we soon discover that the apparent inactivity is illusionary and but the result of a slower change than in the world of animate life. For here too is unceasing struggle and progress. Could we read the history of the forest in all its details it might be almost as replete with dramatic interest as any account of human events. There would be records of the rise and fall of dynasties, of long campaigns, conquests,

great migrations and sudden catastrophes. It would contain episodes of bold adventure and sudden turns of fortune, and accounts would not be lacking of ancient feuds, of friendships and firm alliances. The annals of these strange events are written in an obscure and varied language, but for the characters of which science is finding a key and enabling us to piece together portions here and there. Its early fragmentary records, impressed upon clay or inscribed upon stone lie deep buried in hills and plains. But in the living forests also the runic lines are scattered about and may often be read in characters of leaf and bud and flower, in atavisms and reversions toward ancient types, in strange associations and chains from which many links are missing. Here we come across small colonies isolated in some retreat far removed from their kind and kindred, and there we find in our northern forest a single representative of a tropical family or a species that appears to have survived from an earlier period. These larger questions and the romance of science they involve are, to be sure, somewhat beyond the scope of the present paper, which proposes only to describe briefly the ligneous flora of a small area particularly rich in species of the southern forest belt. Such localities, however, are replete with suggestions and evidence regarding the history and evolution of our floras. Nor could we hope to find even in the rich luxuriance of the tropical jungles nor amid the weird forms of the antipodal desert more interesting fields for investigating such questions than in our familiar American forests.

In that magnificent forest that but a century or so ago covered nearly all of eastern North America from the valley of the St. Lawrence and the Lakes to the Gulf of Mexico beyond the Mississippi, civilization and settlement have made great changes. Vast areas have been cleared and brought under agriculture. Axe and saw and fire-brand employed unceasingly have laid low magnificent stands of conifers and hard wood species; swamps have been drained and mountain sides denuded and cities and towns now flourish where was lately the heart of the wilderness. Beneficent as this progress in the main doubtless is, even though, as we are often reminded, it was prosecuted in many cases with little regard to present economy or future need, yet one cannot help reflecting with regret upon the tremendous interest and value that would have attended a comprehensive survey of the whole region under modern scientific methods, had such a thing been possible, while it was still practically intact. Even now, although we are beginning to take stock of what remains and to talk of conservation and reforestation, in many of the more recently settled parts of the country the work of destruction goes on unchecked. In travelling through portions of the South and Southwest one still commonly sees crops of cotton and corn planted in "deadenings," where the smaller plants have been cleared away and thousands of splendid specimens of Oaks, Hickories, Elms, Gums and other trees have been "girdled" and left to slow decay. One still sees in such sections each spring huge piles of logs and brush brought together to be burned and got rid of as so much

incumbrance to the land. In the lumbering districts it is not uncommon to see merchantable timber being felled and removed at the lowest possible present cost without regard to conserving the younger growth, which indeed is often later wantonly destroyed by fire, leaving large tracts as barren wastes incapable of reforesting themselves and quite worthless for agricultural or even for grazing purposes. In other sections the work of drainage and levee building is restricting more and more the swamp lands where formerly the Bald Cypress and other species flourished. Even where detached areas of the forest remain, almost everywhere within the region we are considering, many of the finer and more valuable trees have been culled out, and often in the vicinity of cities or centers of industry certain species are nearing extinction and others of foreign introduction are becoming mixed with the native growth. In spite of all these inroads, however, we of the present generation may still congratulate ourselves on the fact that in many remote places considerable remnants of the forest do remain, where it is possible to observe many phases of it practically under primitive conditions. It is perhaps needless to point out that the botanists of the future will not be so fortunate; for even though present destructive tendencies should be checked and the reverse prevail, the things restored will not be as they were in the beginning, and planting or even scientific forest management, desirable as they may be, must destroy to some extent the natural, primitive conditions so important to the scientific investigator.

Among localities in the southern portion of the great forest belt of eastern North America, which have been somewhat thoroughly explored by representatives of the Arnold Arboretum within the last few years, the following may be mentioned as examples in various ways possessing exceptional interest for the dendrologist. The vicinity of Selma, Dallas County, Alabama; the valley of White River and its tributaries in the Ozark region of southern Missouri and northern Arkansas; a section of the Kiamichi Mountains near Page, Le Flore County, Oklahoma; the canyons of the Guadalupe, Sabinal, Frio, Nueces and other streams in the Edwards plateau of southwestern Texas; the vicinity of San Augustine, in eastern Texas, and that of Fulton, on Red River, in southwestern Arkansas.

Considerable work has been done by agents of the Arboretum in each of these localities, the results of which is represented by large collections preserved in the herbarium; many interesting trees and shrubs brought into cultivation here for the first time and descriptions of a number of species and varieties new to science that have appeared in its publications from time to time.

Selma, Alabama, which has furnished one of the largest lists of woody plants of any locality in the United States, has not been visited by the writer. Professor R. S. Cocks, of Tulane University, and Mr. T. G. Harbison, however, have made large collections there and Professor Sargent has also visited it. A brief account of some of the peculiar plants

of the Edwards plateau was published in a former issue of this Journal (I. 233-239), although the list was an incomplete one; in another number (II. 216-232) mention was made of the interesting plants of the White River valley, and in the present paper it is proposed to give some account of the rich ligneous flora in the vicinity of Fulton, Arkansas.

The village of Fulton is situated on the west bank of Red River a short distance below the mouth of Little River. It is a station on the Missouri Pacific railway about 28 kilometers (18 miles) from the thriving town of Texarkana. In the steamboat days and before the coming of the railroads it was a trading and shipping point of some importance on account of the extensive cotton plantations in the fertile valley. During the civil war it was fortified by the Confederates in an attempt to hold the river against the advance of the Union gun boats. The trenches and gun pits on the hills above the town are still plainly visible. The present population is about five or six hundred, a large percent of which is colored. The village is protected by a levee, as otherwise it would be completely inundated by the river when it reaches flood stage, which usually occurs once or more a year. The river here forms the boundary between Hempstead and Miller Counties. It is spanned by a large railway bridge but for other crossing only a ferry is available. In the life of the community the big muddy stream is a dominating factor. To it is due the fertility of the valley and the big crops of cotton, and prosperity when seasons are favorable. But the flood demon in his angry moods is a constant menace to both planters and townfolks, assailing and often carrying off large sections of the low silt river banks and not infrequently devastating the whole wide valley with the tremendous volume of water that come down from the spring freshets in Texas and Oklahoma; and if in the immediate vicinity of the town he has been baffled of his prey by the defensive works of man he takes mean revenge in such small annoyances as mosquitos and malaria.

Opposite the town, on the Miller County side, is an extensive bottom, in places four to six kilometers wide. Much of the land has been brought under agriculture and portions of it are protected by double courses of levees, but there are still extensive tracts of semi-swamp lands covered with characteristic forest. The higher portions are occupied by open woods containing comparatively few species, amongst which *Populus balsamifera* var. *virginiana* Sarg., *Carya pecan* Engl. & Graebn., *C. cordiformis* K. Koch, *C. ovata* K. Koch, *C. myristicaeformis* Nutt., *C. Buckleyi* var. *arkansana* Sarg., *Quercus alba*, L., *Q. macrocarpa* Michx., *Q. rubra* L., *Q. Shumardii* Buckley, *Ulmus american* L., *U. crassifolia* Nutt., *U. alata* Michx., *Celtis laevigata* Willd., *Liquidambar styraciflua* L., *Nyssa sylvatica* Marsh., *Acer Negundo* var. *texana* Sarg., *Fraxinus americana* L. and *F. pennsylvanica* var. *lanceolata* Sarg. are most abundant. Some fine specimens of *Quercus Durandii* Buckl. are occasionally found, usually occupying slight elevations, and amongst smaller trees, growing where the dominant species are less crowded or are an underworth in strict sub-

jection to them, may be mentioned *Carpinus caroliniana* Walt., *Ostrya virginiana* K. Koch., *Cornus asperifolia* Michx., *Diospyros virginiana* L., *Bumelia lanuginosa* Pers., *Prunus mexicana* Wats., *Crataegus viridis* L., *C. spathulata* Michx. and *Cercis canadensis* L. There is generally here but slight development of shrubs or herbaceous plants. *Ilex decidua* Walt., *Benzoin aestivale* Nees, *Forestiera acuminata* Poir. and *Callicarpa americana* L. are abundant in places, and sometimes about the roots of a large tree on a low mound smaller shrubs, such as *Arundinaria macrosperma* Michx. and species of *Rubus* and *Vaccinium* find foothold. Commonest of all, however, is the Palmetto, *Sabal minor* Pers., which often covers large areas where the tree growth is not too dense. Woody vines also play a very subordinate rôle. The commonest ones noted here are the Grapes, *Vitis cinerea* Engelm. and *V. cordifolia* Michx., the Virginia Creeper, *Parthenocissus quinquefolia* var. *hirsuta* Planch., *Rhus Toxicodendron* L., *Berchemia scandens* Trel. and *Brunnichia cirrhosa* Banks.

In these low woods the trees generally develop slender straight trunks and the stand is often heavy. Many of them attain a large size, and while much culling has now been done, especially among the species most valuable for lumber, some magnificent specimens of Cottonwood, Oaks, Elms, Hickories and Gums may yet be found.

Numerous bayous and small lakes, often vestiges of former river channels, are encountered, and along their margins and in shallower depressions real swamp conditions prevail. Along the banks of the river and smaller bodies of water the tall stems of the Black Willow, (*Salix nigra* var. *altissima* Sarg.) is very common. Specimens 30 meters tall and more than a meter in diameter are not rare. This tree grows here with a straight clear trunk and has thick, very deeply fissured bark. Characteristic of the real swamp areas and depressions where water remains for a considerable part of the year are The Bald Cypress (*Taxodium distichum* Rich.), Swamp hickory (*Carya aquatica* Nutt.), Water Oak (*Quercus nigra* L.), Overcup Oak (*Q. lyrata* Walt.), Water Elm (*Planera aquatica* Gmel.) and Swamp Honey Locust (*Gleditsia aquatica* Marsh.). Common also to this habitat are *Carpinus caroliniana* Walt., *Liquidambar styraciflua* L., *Crataegus viridis* L., *Acer rubrum* L. and *Fraxinus pennsylvanica* var. *lanceolata* Sarg. Amongst smaller growth is the Palmetto, Small Cane (*Arundinaria macrosperma* Michx.), *Itea virginica* L., *Forestiera acuminata* Poir. and *Cephalanthus occidentalis* L., the last two species often forming extensive thickets. Rank growths of sedges, grasses, rushes, ferns and other aquatic herbaceous plants often accompany these. The margins of some of these swampy lakes are almost tropical in appearance, with various species of lofty trees interspersed with a tangle of shrubs and vines coming down to the water's edge, among them Bald Cypress with straight columnar trunk rising from a buttressed base, sometimes four or five meters in diameter and well out in the water, surrounded by a grotesque assemblage of the aerial root cones, commonly known as "knees," and little mounds

of islands formed about great rotting stumps and linked together by a criss-cross of moss-grown logs, upon all of which small shrubs, tufts of grass and a variety of other plants are growing, while the surface of the stagnant water is covered with a thick scum of green algae, Riccias, Lemnas and sometimes *Azolla caroliniana*. This miasmatic tranquillity is occasionally disturbed by a turtle gliding off a log or a moccasin or cottonmouth uncoiling and sliding lazily into the slime. Some of these bayous abound in fish, and alligators were formerly and I believe are still occasionally found in them. Some giant alligator-gars have been taken in Red River at Fulton. Besides some aquatic birds and frogs little other animal life is now to be seen about the swamps.

Before leaving the low woods it should be explained that the whole area we have been describing is subject to inundation whenever the river is at flood stage, and usually for weeks or even months during the spring and early summer water stands from one to six or more decimeters over the higher flat portions often leaving its uniform mark upon the tree trunks after it has receded. Later in the season most of the land becomes quite dry while the water is restricted to the lakes and bayous.

On the opposite side of the river, in Hempstead County, an escarpment rises with a maximum height of about six or eight meters above the first terrace approaching to within about half a kilometer of the stream just north of Fulton. This escarpment, obviously representing an old bank of the river, is capped with clay and gravel of the Pliocene period (Lafayette). The pebbles and boulders of silicious rock are thoroughly rounded and water worn, and were evidently originally derived from the Paleozoic deposits of the Ouichita Mountains to the northward. Beneath the Tertiary clay and gravel are beds of soft marly fossiliferous sandstones alternating with clays, which outcrop along the margins of the elevation and in deep ravines somewhat farther north, as will be mentioned later. The uplands, of which the escarpment at Fulton forms the southern boundary, extend westward to the valley of Little River and northward toward the Little Missouri. The surface is generally flat and where the clay and gravel deposit is present the soil is of low fertility and the drainage poor. After the heavy spring and autumn rains water stands for some time in every slight depression, and after it has disappeared the ground becomes hard and baked. Here is developed the typical "flat woods," composed of a mixed growth of Pine and deciduous trees. Two species of Pine are present, *Pinus taeda* L. and *P. echinata* Mill. The former is much more abundant than the latter, in places forming a large percentage of the forest and even developing pure stands over small areas. Amongst broad-leaved trees Hickories and Oaks are most abundant, both in individuals and number of species. Characteristic deciduous species here are *Carya alba* K. Koch, *C. Buckleyi* var. *arkansana* Sarg., *C. ovalis* var. *obcordata* Sarg., *C. myristicaeformis* Nutt., *Quercus alba* L., *Q. stellata* Wang., *Q. phellos* L., *Q. rubra* L., *Q. Shumardii* Buckl., *Ulmus alata* Michx., *Liqui-*

dambar Styraciflua L., *Prunus mexicana* Wats., *Crataegus spathulata* Michx., *C. apiifolia* Michx., *Nyssa sylvatica* Marsh. and *Fraxinus americana* L. In the uplands as in the low woods the slight development of the lower layer of shrubs and herbaceous plants is noticeable. Small patches or single individuals of such minor trees and shrubs as *Prunus* and *Crataegus*, *Ilex decidua* Walt., *Vaccinium arboreum* Marsh., *Rubus Andrewsianus* Blanch., *Rhus copallina* L. and *Rosa setigera* Michx. are sometimes found along the borders or in the more open portions. Grasses and herbaceous flowering plants are generally almost entirely absent. In a few larger openings, on the banks of streams and along the escarpment many other species appear and something like thickets with a tangle of shrubs and vines is developed. In such places grow several additional species of *Crataegus* of the *Crus-galli*, *Virides* and *Punctatae* groups, *Malus ioensis* var. *Palmeri* Rehd., *Zanthoxylum Clava-Herculis* L., *Cercis canadensis* L., *Diospyros virginiana* L., *Bumelia lanuginosa* Pers., *Smilax bona-nox* L., *Berchemia scandens* Trel. and *Ampelopsis arborea* Koehne. Many kinds of non-woody flowering plants also manage to thrive here. Where the clay and gravel are much eroded, as is sometimes the case on steepish hillsides, a somewhat more xerophytic phase of the flora is developed. *Juniperus virginiana* L., *Maclura pomifera* Schneid., *Berchemia scandens* Trel. and *Cocculus carolinus* DC. seem at home here, and some of the herbaceous species are even more characteristic, such as *Ophioglossum Engelmanni* Prantl, *Agave virginica* L. and *Opuntia humifusa* Raf.

Where the Lafayette gravel and clay is absent and the Cretaceous formations appear on the surface, conditions are very different. The soil is of a loose sandy loam, often quite fertile on account of the shell-marl and humus which it contains. The surface is easily eroded and often deep gullies and canyons are found working back into the plateau. Perennial springs issue in some of these hollows, and their banks are clothed with many species of ferns, flowers and shrubs. Sometimes remnants of the gravel and clay cap the domes or ridges between the ravines, and there is a descending scale of sterile gravelly flat, sandy slopes, deep protected banks and lower down perhaps a sandy bog bordering a stream or bayou. It is in such situations that the peculiarly rich flora has developed and many of the rare plants are found. A short distance southwest of the railway station at the village of McNab, near the junction of Yellow Creek and Little River, these conditions are typically developed. A deep cut in the railway grade gives an excellent exposure of part of the geologic section. Layers of soft sandstone from one to two meters thick, carrying many large calcareous oyster shells and other fossils, were seen with five or six meters of fine unconsolidated sand above and a similar deposit beneath. Near the point where the railroad crosses Little River the valley is bounded by a bluff, the highest and most precipitous to be found in the vicinity. At the highest point it rises perhaps 18 to 20 meters above the valley, and as it has a northern exposure and a slope of from 60 to 75

degrees it is a most favorable situation for the growth of many plants. Near the top of this bluff and along the gravelly ridge above is found one of the rarest of American Oaks, *Quercus arkansana* Sarg. This is near the type locality where it was first discovered by Mr. B. F. Bush in 1909. It is a small tree, seldom exceeding 10 meters in height with a trunk diameter of 50 centimeters. It has rough dark furrowed bark resembling that of the Black Oak. The foliage is somewhat similar to that of *Quercus marilandica* but the leaves are much smaller, thinner and of a distinct pattern. Its small fruit suggests affinities with *Quercus nigra*, but it certainly is not a hybrid between them, and is indeed a very distinct species. Within a radius of six or seven kilometers of the village of McNab I have examined carefully scores of specimens of this curious Oak, and doubtless many hundreds could be found, but it appears to be strictly limited to the sand hills and small streams traversing them in the Fulton region. Since becoming acquainted with it several years ago I have made diligent search for it in other localities in Arkansas and surrounding states where conditions appeared favorable, but so far it has proven entirely fruitless. An interesting sequel is, however, that it has apparently been found near Troy, Pike County, Alabama, where it was collected as long ago as 1880 by Dr. Chas. Mohr, and in 1912 and 1913 by Dr. Roland M. Harper. Dr. Harper's specimens in the Arnold Arboretum Herbarium represent both the young leaves and flowers and the mature leaves with a single fruiting cup. On Dr. Mohr's specimen, taken on July 4th, the leaves are mature and fruit about half grown. In these specimens the leaves are rather thinner and more nearly glabrous than in most of those from the Fulton region, but some of the specimens from McNab closely match them in these respects. In leaf type, scales of the fruit cup, winter buds and other characters there is close resemblance. Indeed there is fully as great a range of variability in all these respects between different specimens taken near the type locality as between the type specimens and those from the Alabama trees. Since the two localities are so far removed from each other and, so far as present knowledge goes, *Quercus arkansana* is comparatively rare and quite local at both places, the circumstance is very interesting and its significance will be referred to later in this article.

Other Oaks growing along the upper portion of the bluff at McNab and on the ridge above it are *Quercus marilandica* Muench., *Q. alba* L., *Q. Muhlenbergii* Engelm., *Q. Durandii* Buckl. and *Q. stellata* Wang. and a hybrid between the last two species, represented by a single tree, also occurs. It is a tree 8 or 9 meters in height, with pale, slightly flaky bark, more nearly resembling that of *Q. Durandii*. The variable leaves and the fruit are quite intermediate between the two supposed parents, both of which are growing in close proximity to the hybrid. Lower down on the bluff are some fine specimens of *Quercus Shumardii* Buckl., and *Q. phellos* L., *Q. nigra* L. and *Q. lyrata* Walt. are all growing in low ground just below its base. On the dryer portions of the bluff are

also found *Juniperus virginiana* L., *Pinus taeda* L., *Ulmus alata* Michx., *Celtis laevigata* var. *texana* Sarg., *Morus rubra* L., *Ostrya virginiana* K. Koch, *Diospyros virginiana* L., *Bumelia lanuginosa* Pers., *Fraxinus americana* L., *Rhamnus caroliniana* Walt. and *Viburnum rufidulum* Raf. Growing usually lower down on the protected slopes are *Arundinaria tecta* Michx., *Sassafras officinale* Nees & Eberm., *Carpinus caroliniana* Walt., *Liquidambar styraciflua* L., *Nyssa sylvatica* Marsh., *Cornus racemosa* Raf., *Ilex decidua* Walt., *I. caroliniana* Trel., *Hamamelis macrophylla* Pursh, *Cercis canadensis* L., *Robinia Pseudoacacia* L., *Tilia floridana* Small, *Acer saccharum* var. *glaucum* Sarg. and *Fraxinus quadrangulata* Michx. Of the species enumerated above *Ilex caroliniana* is apparently rare and local, not having been noted elsewhere in the vicinity, although it might probably be found in similar situations. *Hamamelis macrophylla* is also comparatively rare here, but is found more abundantly along small sandy creeks in the vicinity. *Robinia Pseudoacacia* is rather abundant and is certainly native here, although beyond the range usually assigned to it. Of *Fraxinus quadrangulata* there are a number of medium sized trees growing well down towards the base of the bluff. So far as I know this station is the farthest southwest at which it has been found.

A large number of herbaceous plants, some of them apparently quite local, are growing along the bluff, and there is the same curious mingling of northern and southern forms amongst them as in the ligneous species. On the dry ridges and in the deep ravines in the immediate vicinity of this bluff are the type localities of *Prunus mexicana* var. *fultonensis* Sarg., a quite distinct variety of the "Big Tree" Plum; of *Aesculus Bushii* Schneider, a hybrid between *Ae. glabra* var. *leucodermis* Sarg. and *Ae. discolor* var. *mollis* Sarg.; of *Crataegus brachyphylla* Sarg., *C. lacera* Sarg. and of *C. notha* Sarg., the last a hybrid between *C. apiifolia* Marsh. and *C. brachyphylla*. Another interesting tree found in this vicinity is *Sophora affinis* T. & G., a southern species most abundant on the limestone hills of central and western Texas. Here it grows on the top and slopes of the gravelly ridges, where it attains a medium size for the species and flowers and fruits freely.

Descending into the moist sandy ravines we find, especially on the north sides, the banks clothed with ferns and herbaceous flowering plants and such shade loving woody species as *Evonymus americanus* L. and *Vaccinium virgatum* Ait. In such situations is often found the delicate little Partridge Berry (*Mitchella repens* L.) and sometimes such Orchids as *Hexalectris*, *Spiranthes* and *Corallorrhiza*.

The springs that issue from some of the deeper of these canyons and the quantities of fine sand and humus eroded through their action and that of the intermittent floods spread out over the low grounds in the valleys and form bogs. These sometimes have quite a characteristic flora. Typical of such situations and their environs are *Myrica cerifera* L., *Itea virginica* L., *Amorpha paniculata* T. & G., *Alnus rugosa* K. Koch,

Lyonia ligustrina DC., *Vaccinium corymbosum* L., *Rhododendron oblongifolium* Millais, and *Styrax americana* Lam. The Small Cane (*Arundinaria macrosperma* Michx.) and the Palmetto (*Sabal minor* Pers.) are also found here. Amongst woody climbers are *Wisteria macrostachya* Nutt., *Smilax laurifolia* L., *S. lanceolata* L. and *Vitis palmata* Vahl. A number of trees are found but they are scarcely so characteristic as the shrubs, since most of them occur also in the low swampy woods of the river bottoms. *Taxodium distichum* Rich., *Planera aquatica* J. F. Gmel., *Carpinus caroliniana* Walt., *Betula nigra* Marsh., *Salix nigra* Marsh., *Liquidambar styraciflua* L., *Acer rubrum* var. *Drummondii* Sarg. and *Fraxinus pennsylvanica* var. *lanceolata* Sarg. are amongst the commonest species. Rank growths of the Cinnamon and Flowering Ferns, *Woodwardia areolata* Moore, *Asplenium Filix-femina* Bernh. and several others, besides Orchids, Sundews and other rare and interesting small plants flourish in such situations. These spring-fed bogs in turn are the sources of or tributary to small creeks, the shady but well-drained bottom lands of which support a varied forest flora. In addition to many of the species mentioned previously as occurring in the bogs and low woods, several appear to be most at home in such locations. Amongst these are *Aralia spinosa* L., *Benzoin aestivale* Nees, *Symplocos tinctoria* L'Her., *Acer floridanum* Pax, *Tilia caroliniana* Mill., *T. caroliniana* var. *rhoophila* Sarg., *Ilex opaca* Ait., and *Vitis rotundifolia* Michx.

As the soil of these little valleys is of high fertility, at least for a few seasons after it has been cleared for agriculture, but few examples of this composition of the forest remain. Indeed throughout the whole region about Fulton the work of clearing and destroying the forest is going on with great rapidity, and in the portions that remain most of the finest specimens of trees valuable for lumber have been culled out. Within the last few years many of the small swamps and bogs have been drained and through the construction of levees and ditches a great deal of bottom land has been added to the cultivated area. From one to three saw logs are usually obtained from the largest trees of Pine, Cypress or Oak, and the remainder is left to decay where felled. When the land is to be brought into cultivation the general practice is to clear out the smaller growth and dispose of this and the dead tree tops by fire, to then deaden the remaining large trees and leave them to slow decay while crops are laboriously cultivated amongst them. Even more distressing to the forest lover and the botanist is the sight of the wholesale destruction of Ash and Hickory on the uplands in search for 'handle material, the trees often yielding only one or two short cuts suitable for this purpose, or to see such interesting trees as *Quercus Durandii* or *Q. arkansana* felled to obtain a single railroad tie. Much of the uplands that are now being cleared are also of very slight value for agricultural purposes, some of them being too sterile and ill drained and others in the sand hill section being subject to rapid destructive erosion as soon as the protecting forest cover has been removed.

Of the following list of woody plants nearly all have been noted or collected by the writer in the Fulton region. In a few cases species have been included on the evidence of herbarium specimens preserved at the Arnold Arboretum, chiefly collected by Mr. B. F. Bush, who visited the locality several times and made extensive collections there. Some omissions doubtless occur, as no attempt was made while in the field to compile a list for the entire region.

PINACEAE

Pinus taeda L. Often common in flat upland woods, but usually growing in mixed stands with Hickories, Oaks and other broad-leaved trees.

Pinus echinata Mill. Growing in similar situations as the last species but less common.

Juniperus virginiana L. Nowhere very abundant but most frequent on clay slopes and barrens along the escarpment; sometimes also found in low woods and on banks of ravines in the sand hills.

Taxodium distichum (L.) Rich. One of the largest and most striking trees, growing in swamps and along the margins of lakes and bayous.

GRAMINAE

Arundinaria macrosperma Michx. A common shrub of the lowlands and along the margins of sandy bogs. Extensive cane-breaks, however, are not developed in this section and the canes seldom exceed two or three meters in height and three or four centimeters in diameter.

PALMAE

Sabal minor (Jacq.) Pers. Often common and growing in large patches in the low swampy woods and also sometimes found in bogs in the sand hills section.

LILIACEAE

Smilax rotundifolia L. Low woods and thickets; often abundant.

Smilax glauca Walt. Common in low swampy woods and sandy bogs.

Smilax bona-nox L. Abundant in dry thickets and clay barrens; also growing in low fields and along railroads.

Smilax lanceolata L. A tall growing species found in rich sandy woods and bogs.

Smilax laurifolia L. Growing in similar situations to the last and of like habit.

JUGLANDACEAE

Juglans nigra L. Sometimes growing to a good size in well drained upland woods, but nowhere very common.

Carya pecan Engl. & Graeb. Not uncommon on river banks and in low woods.

Carya cordiformis (Wang.) K. Koch. A rather abundant species in low woods where it grows to a large size, trees 30 to 35 meters in height and

one meter or more in diameter being sometimes met with. It is also found on bluffs and banks of small streams where it is usually much smaller.

Carya cordiformis var. *latifolia* Sarg. The broad leaved form of the Pignut is sometimes found on bluffs and in upland woods.

Carya myristicaeformis (Michx. f.) Nutt. This comparatively rare Hickory, with its curious nutmeg-like fruit, is perhaps more abundant in the Fulton region than anywhere else. It is found both in low woods and in the flat uplands. It has pale scaly bark and often becomes a fine tree up to 30 or 35 meters tall.

Carya aquatica (Michx. f.) Nutt. A large tree common in low swampy woods. The bark is usually very shaggy and the wood is said to be of inferior value to that of the other Hickories.

Carya ovalis var. *obcordata* Sarg. This form of the small fruited Hickory or Pignut, as it is often called in the north, is occasionally found on bluffs or in flat upland woods, and it probably reaches about its southwestern limit here.

Carya alba (L.) K. Koch. Common in flat upland woods and on gravelly ridges.

Carya ovata (Mill.) K. Koch. Found occasionally in flat upland woods, but not very common.

Carya Buckleyi var. *arkansana* Sarg. This is the commonest Hickory of the region, and it often forms a large percentage of the woods on flat uplands. It is also sometimes found in the low woods, on the sand hills and in almost all situations except in the permanent swamps. It becomes a medium sized tree up to 20 or 25 meters in height. The wood is valuable and is much sought, with that of other Hickories, for handles and wagon timber. The bark is rather thick and ridgy but not scaly. The fruit is edible but the kernel is closely compressed in a thick shell; it varies greatly in size and shape.

Carya Buckleyi var. *arkansana* f. *pachylemma* Sarg. The type tree of this form was found growing on a bench between the uplands and low bottoms a short distance from Fulton. Although the nut itself is not as large as in some forms of *C. laciniosa* the very thick involucre makes it perhaps the largest-fruited of the Hickories.

MYRICACEAE

Myrica cerifera L. Growing in low sandy woods and margins of bogs.

SALICACEAE

Salix nigra Marsh. Often very common in low woods and along streams.

Salix nigra var. *altissima* Sarg. Large specimens of the tall Black Willow are common on the banks of Red River and in the low woods.

Salix longifolia Muhl. Growing along bayous and banks of streams.

Populus balsamifera var. *virginiana* (Henry) Sarg. Some very large specimens of this Cottonwood are found on the banks of Red River, and it is also often common in low woods.

BETULACEAE

Carpinus caroliniana Walt. Frequent in low woods and along margins of swamps.

Ostrya virginiana (Mill.) K. Koch. A common small tree of upland woods.

Betula nigra Marsh. Frequent on banks of streams and margins of bogs and lakes.

Alnus rugosa (DuRoi) K. Koch. Common in sandy bogs and along small streams in the sandy area.

FAGACEAE

Castanea alnifolia Nutt. Occasionally found in sandy woods and along bluffs and hillsides in the sand hills section.

Quercus alba L. A common Oak, of which many fine specimens occur in upland woods.

Quercus alba var. *latiloba* Sarg. Trees with leaves having broad shallow lobes are sometimes found growing with the typical form. Extreme specimens look distinct but there is a complete gradation between them.

Quercus Durandii Buckley. This species is also popularly known as White Oak, and in bark and wood resembles *Quercus alba*, but in its small irregularly lobed glossy leaves and its extremely small fruit with cups reduced almost to disks, it is very distinct and striking. In eastern Texas, where it is widely distributed but nowhere very common, it grows usually in the better drained portions of low bottoms. Some very fine specimens are found in similar locations near Fulton, but it is even more common on gravelly ridges in the sand hills section. This is apparently the northern limit of its range west of the Mississippi.

Quercus stellata Wang. Rather common in upland woods throughout, but most abundant on dry gravelly ridges.

Quercus macrocarpa Michx. Not rare and growing to a large size in low woods.

Quercus lyrata Walt. A common species of low and swampy woods, growing in wetter situations than any other Oak except *Quercus nigra*.

Quercus Muhlenbergii Engelm. On bluffs and hillsides in the uplands, but nowhere common.

Quercus phellos L. The Willow Oak is one of the commonest species in low woods, and it is often also abundant in flat poorly drained uplands. Fine large specimens are frequent.

Quercus nigra L. A common species of the low bottoms.

Quercus marilandica Muench. Sometimes frequent in upland woods; most abundant on gravelly ridges and eroded hillsides.

Quercus arkansana Sarg. Confined to the sand hills sections where it is locally frequent on the banks of small streams and on slopes and ridges.

Quercus rubra L. This species, the Spanish Oak of the books and the *Quercus falcata* Michx., is commonly called Red Oak in the South. It is one of the commonest species in the Fulton region, being found both in

low woods and on the flat uplands. In the latter environment it often forms a large percentage of the forest. Some magnificent specimens occur, attaining a height of 35 meters or more, a trunk diameter of nearly 2 meters and with a wide spread of branches in more open situations.

Quercus Shumardii Buckley. Commonest in flat upland woods and on banks of streams. A fine handsome species, distinguishable from the variety *Schneckii* by the broad flat, often tubercled cups of its fruit, which in size and shape resembles that of the northern Red Oak. There is often also a marked difference in the leaves of the upper and lower branches, the former being deeply incised and the latter having shallow open sinuses.

Quercus Shumardii var. *Schneckii* (Brit.) Sarg. Often frequent in upland woods; preferring banks and well drained soils. This is a handsome Oak, sometimes attaining a height of more than forty meters and a trunk diameter of more than a meter. The trunk, usually rising from a well buttressed base, is typically straight and free from branches for a considerable height.

Quercus velutina Lam. This species is rather common in places in upland woods.

Quercus velutina var. *missouriensis* Sarg. Common with the last.

× *Quercus subfalcata* Trel. Several individuals of this interesting hybrid between *Quercus phellos* and *Q. rubra* have been found in the flat upland woods in the vicinity of Fulton and McNab.

Quercus nigra × *Shumardii*. A supposed hybrid between these two species has been found on the banks of a small creek a few miles from McNab. The tree is of adult size, perhaps 10 meters in height, but fruit has not yet been collected from it. It is growing in close proximity to the supposed parents.

Quercus Durandii × *stellata*. A single individual, apparently a hybrid between these two species, is growing on the top of a bluff near McNab, as described in a former paragraph of this article.

ULMACEAE

Ulmus americana L. An abundant species in upland woods.

Ulmus alata Michx. Commoner than the last and more widely distributed; often growing in low flat woods as well as on uplands.

Ulmus crassifolia Nutt. The commonest Elm of low swampy woods, but also found on flat poorly drained lands of the Lafayette formation.

Ulmus fulva Michx. Rather uncommon and confined to banks and bluffs of the sand hills section.

Ulmus serotina Sarg. This rather rare, or at least little known, southern Elm has recently been found in low sandy woods near McNab.

Celtis laevigata Willd. Common and growing to a large size in low swampy woods, and also found less abundantly on flat uplands.

Celtis laevigata var. *texana* Sarg. This well marked variety is sometimes found in upland woods and along the banks of small streams.

Planera aquatica (Walt.) J. F. Gmel. A typical species of the swamps, often growing along the margins of lakes and bayous.

MORACEAE

Morus rubra L. Not rare in upland woods, especially along the escarpment, and sometimes also found in the lowlands.

Maclura pomifera (Raf.) Schneid. Found on dry gravelly ridges and eroded hillsides and occasionally in openings along small streams.

LORANTHACEAE

Phorodendron flavescens (Pursh) Nutt. The Mistletoe is often common in the lowlands and on the flat uplands. It is found most frequently growing as a parasite on the Elms, but has also been noted on several of the Red Oaks, on *Nyssa sylvatica*, *Gleditsia triacanthos* and *Platanus occidentalis*.

ARISTOLOCHIACEAE

Aristolochia tomentosa Sims. Growing in low sandy ground along a small creek near McNab.

POLYGONACEAE

Brunnichia cirrhosa Banks. A common woody vine of the low woods, where it attains a large size, climbing to the tops of the largest trees and forming stems sometimes 6 to 8 centimeters in diameter.

ANONACEAE

Asimina triloba (L.) Dunal. Growing as a shrub or small tree in rich woods, especially along small creeks in the sand hills section.

RANUNCULACEAE

Clematis crispa L. This small species is sometimes found in low ground, in thickets and on open banks.

Clematis Simsii Sweet. Sometimes found in thickets and open ground in the sand hills section.

Clematis reticulata Walt. Apparently rare, this species has been collected along sandy bogs near Columbus.

MENISPERMACEAE

Cocculus carolinus (L.) DC. Sometimes common in thickets and barrens and on open banks.

LAURACEAE

Sassafras officinale Nees. & Eberm. A small tree of upland woods and thickets.

Benzoin aestivale (L.) Nees. Rich woods and margins of bogs in the sand hills section; occasionally also found in low woods in the river valley.

SAXIFRAGACEAE

Itea virginica L. Confined to bogs and swamps where it sometimes takes root on decaying stumps and logs.

HAMAMELIDACEAE

Hamamelis macrophylla Pursh. Growing along the banks of small sandy streams where it becomes a small tree or more frequently a tall shrub five or six meters in height.

Liquidambar styraciflua L. One of the largest and commonest of forest trees in the region, sometimes attaining a height of from 30 to 40 meters. It appears to be very adaptable, growing in all sorts of soils and environments from the dry ridges to permanent swamps. In the lowlands and flat upland woods it is often an important constituent of the forest.

PLATANACEAE

Platanus occidentalis L. Growing sometimes to a large size on the banks of rivers and smaller streams, but nowhere very common.

ROSACEAE

Malus ioensis var. *Palmeri* Rehd. A spiny shrub or small tree in thickets and openings along the margins of the uplands.

Rubus Andrewsianus Blanchard. Common in openings of low woods, in upland thickets and along the margins of swamps and bogs.

Rubus trivialis Michx. Thickets and open woods.

Rubus rubrisetus Rydb. Common in low open woods, especially on banks and margins of swamps and bayous.

Rosa setigera Michx. The smooth form of the Prairie Rose is found in thickets and open woods, in rather dry situations.

Rosa setigera var. *tomentosa* T. & G. This form, differing in the pubescence of the leaves and young branches, is sometimes found in similar situations to the last.

Rosa carolina L. This low growing Rose is often found in open sandy woods and in upland thickets. It is the species that long passed under the name of *Rosa humilis* Marsh.

Rosa texarkana Rydb. I have not recognized this species in the Fulton area but as the type was collected by Eggert at Texarkana, only a few kilometers beyond our limits, it is doubtless to be looked for here.

Crataegus apiifolia Michx. A very common species growing in thickets and open woods both in the lowlands and in the driest situations.

Crataegus spathulata Michx. About as abundant as the last named species and growing in similar situations.

Crataegus trianthophora Sarg. A low shrubby form of wide distribution that has been found in open sandy woods.

Crataegus bellica Sarg. The type of this species was collected near Fulton, where it is common in thickets along the escarpment and in openings of upland woods. It has since been recognized at other stations in eastern Arkansas, Texas, Oklahoma and southern Missouri. It is a shrub with remarkably spiny, intricate, zig-zag branches.

Crataegus Bushii Sarg. A small tree, belonging like the last to the *Crus-galli* group. The type locality was Fulton. It is now known also from several stations in western Louisiana, eastern Texas and Oklahoma.

Crataegus palliata Sarg. This small tree also belongs to the Crus-galli group, and type was collected at Fulton. It grows in fertile open woods and on rich hillsides.

Crataegus triumphalis Sarg. A small tree of the Crus-galli group, growing in open upland woods. The type locality is Fulton.

Crataegus sordida Sarg. This is a small tree of the Punctatae group originally described from southern Missouri. Two trees have been found near Fulton, growing in a thicket on the edge of the upland woods, which perhaps belong to this species.

Crataegus fastosa Sarg. A small tree of the Punctatae group growing in low woods. The type locality is Fulton.

Crataegus amicalis Sarg. A species originally described from Fulton, belonging to the Virides group. It is a small tree growing in open upland woods.

Crataegus micrantha Sarg. A small slender tree of the Virides group, growing in low woods near Fulton, from which locality it was originally described.

Crataegus blanda Sarg. A small round-topped tree of the Virides group rather abundant in upland woods and on gravelly ridges in the Fulton region. It differs from most of the other species of this group in its rather thick dark bark. This species has also been found in Alabama, Louisiana and Texas.

Crataegus velutina Sarg. This species closely resembles *C. viridis* L. except in its more or less densely pubescent leaves, branchlets and inflorescence. It is rather common about Fulton which is the type locality and it has also been found in eastern Texas.

Crataegus enucleata Sarg. A small tree of upland woods. Type material of this species was collected at Fulton. It belongs to the Virides group.

Crataegus lacera Sarg. A slender tree growing in rich soil in open situations. It is one of the most interesting species described from the Fulton region, being very distinct in characters and of dubious affinities. It was doubtfully referred to the Tenuifoliae group by Professor Sargent, but it differs markedly from other members of that section, which has no other representative known west of the Mississippi River. It may represent a distinct group of this large genus.

Crataegus viridis L. A very common species growing both in low woods and in the flat uplands. It is one of the largest of all the Haws, sometimes becoming a tree 10 meters or more in height.

Crataegus induta Sarg. This is a small tree of the Molles group growing in upland woods near Fulton, which is the type locality.

Crataegus invisiva Sarg. This species, also belonging to the Molles group, is rather abundant in rich low woods throughout the Fulton region, where it was first found. It has also been collected at San Augustine, in eastern Texas.

Crayaegus limaria Sarg. A medium sized tree of the Molles group, of which Fulton is the type station. It is also found in Oklahoma and has a wide range in Texas, extending to the southwestern part of the state and also into Mexico.

Crataegus brachyphylla Sarg. This recently described species is one of the comparatively rare and local plants of the gravelly ridges and sand hills near McNab. It is a small tree, growing usually in thickets or open hillside woods, and is very distinct from most of the other species of the group.

× *Crataegus notha* Sarg. This interesting plant, supposed to be a hybrid between *C. apiifolia* and *C. brachyphylla*, is growing sparingly on gravel-capped ridges and sandy slopes near McNab. It is a small tree sometimes shrubby in habit, with thin flaky bark, resembling that of *C. apiifolia*. In leaves, flowers and fruit it is quite intermediate between the two supposed parent species, both of which are growing in close proximity to it.

Prunus serotina Ehrh. Not uncommon in upland woods, usually growing on hillsides or in well drained ground.

Prunus angustifolia var. *varians* Wight. Extensive thickets of this shrubby Plum are sometimes found on gravelly hillsides and semi-barrens along the escarpment. It usually grows to a height of from one to two meters and is a free bearer. The fruit is of fair quality and there is both a yellow and red form.

Prunus Munsoniana Wight & Hedrick. Sometimes found in thickets and open woods along the margins of the uplands.

Prunus mexicana Wats. This species is quite common in open upland woods and also sometimes grows in the bottoms. It becomes a large tree for the genus, some specimens measuring ten meters in height with a trunk diameter of three decimeters. It usually bears freely but the fruit is of inferior quality and badly infested with weevil.

Prunus mexicana var. *polyandra* Sarg. Occasionally found in fertile soil, growing in open woods.

Prunus mexicana var. *fultonensis* Sarg. This rather distinct variety is not uncommon in the sand hills section near McNab, from which locality the type specimens came.

Prunus umbellata Ell. A small tree sometimes found in the sand hills section.

Prunus umbellata var. *tarda* (Sarg.) Wight. Found in open woods and on slopes in the sand hills section.

LEGUMINOSAE

Cercis canadensis L. Frequent in open woods and thickets, especially on hillsides in the sandy section.

Gleditsia triacanthos L. Found throughout in upland woods and sometimes in the bottoms, but nowhere very common.

Gleditsia aquatica Marsh. A common and characteristic species of the

low swampy woods, perhaps being more abundant here than anywhere else in its range.

Robinia Pseudoacacia L. Found in thickets along the escarpment and on bluffs and ridges near McNab, where it is certainly native.

Sophora affinis T. & G. This interesting southern tree is growing sparingly along gravelly ridges above the sandstone in the hills near McNab. The trees flower and fruit freely and some of them attain nearly the maximum size for the species.

Amorpha fruticosa L. Growing in open situations in low woods and along the margins of swamps and bogs.

Amorpha paniculata T. & G. A species of eastern Texas that has been found growing in sandy bogs near McNab.

Wisteria macrostachya Nutt. A high climbing vine of sandy bogs and low sandy woods.

Acacia angustissima (Mill.) Ktze. This little shrub, of which the base only is usually woody, has been found in thickets and barrens.

RUTACEAE

Zanthoxylum Clava-Herculis L. Rather infrequent in thickets and open woods, on eroded hillsides along the escarpment and in the sand hills.

Ptelea trifoliata L. Thickets and open hillsides along the escarpment.

ANACARDIACEAE

Rhus Toxicodendron L. Common everywhere in woods and thickets.

Rhus quercifolia (Michx.) Steud. A low shrub, usually not more than half a meter tall, growing in sandy soil of the Cretaceous area.

Rhus glabra L. Occasionally found in thickets and open woods.

Rhus copallina L. On the bluff at McNab and sometimes found elsewhere in flat open woods.

AQUIFOLIACEAE

Ilex opaca Ait. Sandy woods and banks of small streams in the Cretaceous area.

Ilex decidua Walt. A common species, sometimes becoming a small tree, growing in low woods and also in openings and thickets in the uplands.

Ilex caroliniana (Walt.) Trel. This species has been found growing along the north side of the bluff at McNab.

CELASTRACEAE

Evonymus atropurpureus Jacq. Rarely found in open woods and thickets in the uplands.

Evonymus americana L. On moist sandy banks and in woods along small creeks in the Cretaceous area.

ACERACEAE

Acer saccharum var. *glaucum* Sarg. A common tree in the sand hills section, especially on hillsides and along small streams.

Acer floridanum Pax. Abundant in low sandy woods in the Cretaceous area.

Acer rubrum L. Common in low woods and less frequent in the uplands of the sand hills section.

Acer rubrum var. *tridens* Wood. On bluffs and ridges in the sand hills section.

Acer rubrum var. *Drummondii* (H. & A.) Sarg. Common in swampy woods and bogs.

Acer Negundo L. Common in low woods and along streams.

Acer Negundo var. *texanum* Pax. Growing in similar situations to the last and somewhat more common.

Acer Negundo var. *texanum* f. *latifolium* Sarg. This is a common form, growing with the last.

HIPPOCASTANACEAE

Aesculus glabra var. *leucodermis* Sarg. Usually a shrub two or three meters in height; it is found on hillsides and along small streams in the Cretaceous area.

Aesculus glabra var. *micrantha* Sarg. A low shrub, of which the type was collected in this vicinity.

Aesculus discolor var. *mollis* Sarg. This red-flowered species is often abundant on hillsides and along small streams in the sand hills.

× *Aesculus Bushii* Schneid. A supposed hybrid between *Ae. glabra* var. *leucodermis* and *Ae. discolor* var. *mollis*, of which the type specimens were collected by B. F. Bush, near McNab.

SAPINDACEAE

Sapindus Drummondii H. & A. Rather rare in low woods and on gravelly ridges.

RHAMNACEAE

Rhamnus caroliniana Walt. Often abundant in thickets and on gravelly ridges, and sometimes also found in low woods.

Ceanothus americanus L. A low shrub of sandy woods and thickets.

Berchemia scandens (Hill) Trel. Common in thickets, barrens and along the borders of upland woods.

VITACEAE

Vitis cinerea Engelm. Often common in low woods and thickets.

Vitis cordifolia Michx. Rather common in low woods and also found in thickets and along small streams in the uplands.

Vitis palmata Vahl. Grows along the margins of sandy bogs and on banks of small streams.

Vitis Linsecomii var. *glauca* Munson. A species found in sandy upland woods and on the banks of small streams.

Ampelopsis cordata Michx. Growing in thickets and along small streams.

Ampelopsis arborea (L.) Koehne. Common in thickets and in open situations both in the lowland and upland woods.

Parthenocissus quinquefolia (L.) Planch. Rather frequent in woods and thickets throughout.

Parthenocissus quinquefolia var. *Saint-Paulii* (Graeb.) Rehd. A high climber on trees in the low woods.

TILIACEAE

Tilia nuda Sarg. A large tree of the low woods.

Tilia floridana Small. This is the commonest Linden in the Fulton region, growing in low woods and also along hillsides in the sand hills section.

Tilia caroliniana Mill. Growing in sandy woods, especially along small creeks.

Tilia caroliniana var. *rhoophila* Sarg. A southern species that apparently reaches its northern limit of range here. It grows usually in moist sandy woods.

GUTTIFERAE

Hypericum prolificum L. Not uncommon in thickets and sandy woods.

Ascyrum multicaule Michx. An erect slender shrub, up to nearly one meter in height, growing in low sandy woods.

Ascyrum stans Michx. Uncommon in low sandy woods and on moist banks.

ARALIACEAE

Aralia spinosa L. Occasionally found in low sandy woods and along borders of bogs.

CORNACEAE

Cornus florida L. Commonly growing in open upland woods, especially in the sand hills section.

Cornus asperifolia Michx. Growing both in openings in low woods and in thickets and borders of the upland woods.

Cornus racemosa Lam. Bluffs and hillsides, especially in the sand hills section.

Cornus stricta Lam. This species is confined to the low wet woods, swamps and bogs.

NYSSACEAE

Nyssa sylvatica Marsh. A common and widely distributed tree, being found sometimes in the low woods, but more common in the flat uplands and in the sand hills section.

ERICACEAE

Vaccinium arboreum Marsh. A common small tree, or sometimes a shrub, in the flat upland woods, and also in the sand hills.

Vaccinium arboreum var. *glaucescens* (Small) Sarg. Growing usually on bluffs or hillsides in the sand hills section.

Vaccinium virgatum Ait. A slender shrub found on moist sandy banks and in low sandy woods.

Vaccinium vacillans Kalm. This species usually grows in dryer situations than the last. It is often common in the sandy woods.

Vaccinium corymbosum L. A species confined to the sandy bogs and wet sandy woods. It is a shrub, often growing with a single tree-like stem, up to a height of two or three meters.

Lyonia ligustrina (L.) DC. This shrub is confined to the low sandy woods and sandy bogs.

Rhododendron oblongifolium (Small) Millais. This pretty flowering shrub of the southern states is local and rather rare in sandy bogs near McNab.

SAPOTACEAE

Bumelia lanuginosa (Michx.) Pers. A common small tree, sometimes found in the low woods, but more abundant in the uplands and especially in the sand hills section.

EBENACEAE

Diospyros virginiana L. A not uncommon species, growing both in the lowlands and flat open woods. It is most abundant in thickets and opening along the borders of the uplands. So far as I have observed the larger fruited form (var. *platycarpa* Sarg.) does not grow here.

STYRACEAE

Styrax americana Lam. Growing in low swampy woods and in sandy bogs.

SYMPLOCACEAE

Symplocos tinctoria (L.) L'Hér. A small slender tree, growing in low sandy woods and on the borders of bogs near McNab.

OLEACEAE

Fraxinus americana L. A common forest tree, growing sometimes in low woods, but most abundant in the flat uplands. It also is found on bluffs and ridges in the sand hills section.

Fraxinus pennsylvanica var. *lanceolata* (Borkh.) Sarg. A common tree, sometimes growing to a large size, in low woods and along the margins of swamps and bogs.

Fraxinus quadrangulata Michx. This species is apparently rare and has been noted only on bluffs with northern exposure near McNab.

Forestiera acuminata Poir. A common shrub in low woods, swamps and bogs.

Forestiera acuminata var. **vestita**, var. nov. Varying from the type in having the leaves, petioles and young branchlets more or less densely clothed with straight short pubescence, which is persistent to the end of the season and even in some cases is found on the slender branchlets of the second season; on the typical form there is only sometimes a slight trace of pubescens on the petioles and veins of the young leaves. A specimen collected by B. F. Bush, No. 2468, Miller County,

Arkansas, April 27, 1905, and distributed as *Adelia pubescens* (Nutt.) Ktze., may be taken as the type of this variety. Mr. Bush's specimens were in flower and young leaf. The pubescent variety is also represented by the following additional specimens in the Arnold Arboretum Herbarium:

ARKANSAS. Van Buren, Crawford County, *E. J. Palmer*, No. 21008, April 29, 1922, with young fruit; Fulton, Hempstead County, *B. F. Bush*, no. 5458, April 5, 1909, with flowers, young leaves and pubescent old branchlets; Miller County (opposite Fulton), *E. J. Palmer*, No. 22268, October 11, 1922, with old leaves densely pubescent beneath, and pubescent branchlets.

LOUISIANA. Richland, Rapides Parish, *R. S. Cocks*, No. 19, June, 1908.

APOCYNACEAE

Trachelospermum difforme (Walt.) A Gray. Low woods, thickets and borders of bogs.

VERBENACEAE

Callicarpa americana L. A rather common shrub found sometimes in openings of low woods, but more abundant in the uplands and sandy section.

BIGNONIACEAE

Catalpa speciosa Engelm. Several small specimens of this species were seen along a small sandy creek near McNab, but I am inclined to think it is a recent introduction here from cultivated trees.

Campsis radicans (L.) Seem. Growing along small streams in the sandy section and sometimes along open banks throughout.

Bignonia capreolata L. A high climbing vine, not uncommon in woods.

RUBIACEAE

Cephalanthus occidentalis L. Very common in opening of low woods and in swamps and bogs.

Cephalanthus occidentalis var. *pubescens* Raf. The pubescent form is sometimes found along sandy streams and in sandy bogs.

CAPRIFOLIACEAE

Viburnum rufidulum Raf. A common small tree growing both in bottoms and uplands, but most abundant in thickets and openings along the escarpment.

Symphoricarpos orbiculatus Moench. Sometimes found in thickets and openings in woods, but not very common.

Lonicera sempervirens L. Found in thickets along small streams, especially in the sand hills section. Some of the specimens collected here have rather narrow oblong leaves, finely pubescent beneath, and small flowers, and may represent a distinct variety.

Sambucus canadensis L. Often common in open woods in the bottoms and in thickets along small streams.

Sambucus canadensis var. *submollis* Rehd. This pubescent form is often abundant along small creeks in the sand-hill sections.

In looking over the above list, comprising nearly two hundred species and varieties of woody plants, and comparing it with similar lists from other parts of the general region, it will readily be seen that the representation of the forest flora is very full in the small area within a radius of about five kilometers of Fulton, which has been described, and that besides a few plants peculiar to the region there are several others both of northern and southern range whose presence is rather surprising here. The locality, it should be remembered, is well within the boundaries of the southern division of the Atlantic forest belt and therefore no such diversity is to be expected as might occur along the boundary of two life zones or sub-regions, such as we begin to encounter a few degrees of longitude farther west.

Among plants having a range to the north and east and which appear to reach about the southwestern limits of their range here may be mentioned *Carya ovalis* var. *obcordata* Sarg., *Malus ioensis* var. *Palmeri* Rehd., *Rosa carolina* L., *Robinia Pseudoacacia* L., *Aesculus glabra* var. *leucodermis* Sarg., *Ceanothus americanus* L. and *Fraxinus quadrangulata* Michx. The Crabapples are extremely rare or entirely absent over most of eastern Texas, and when the genus does reappear in the canyons of the Edwards plateau it is represented by a distinct variety (*Malus ioensis* var. *texana* Rehd.). *Robinia Pseudoacacia* L. is undoubtedly native in the mountainous regions of eastern Oklahoma, being very abundant on the sandstone slopes of some of the hills in the Kiamichi range. That it once extended much farther south and west than its present general range is indicated by its presence in protected situations here, where it is probably making its last stand. In much the same case is *Fraxinus quadrangulata* Michx., which is also essentially a species of rocky hills and mountainous regions. On the other hand are such southern and southwestern trees as *Carya myristicaeformis* Nutt., *Quercus Durandii* Buckl., *Sophora affinis* T. & G., *Amorpha paniculata* T. & G., *Tilia caroliniana* var. *rhoophila* Sarg., *Sabal minor* Pers. and *Symplocos tinctoria* L'Hér., which seldom appear so far north, at least west of the Mississippi.

There is another group, to which belong *Quercus arkansana* Sarg., *Prunus umbellata* var. *tarda* Wight, *P. mexicana* var. *polyandra* Sarg., *P. mexicana* var. *fultonensis* Sarg., *Crataegus lacera* Sarg., *C. brachyphylla* Sarg., and in a somewhat different degree such species as *Carya myristicaeformis* Nutt. *Ulmus serotina* Sarg., which are so far as now known either local about the Fulton region or if of wider distribution crop up only here and there in widely detached localities, and are probably surviving remnants of species once common and widely dispersed. *Quercus arkansana* is a form of considerable scientific interest. As already stated it appears to be more nearly related to *Q. nigra* and *Q. marilandica* than to any other known species, and in some respects it is intermediate between them. Both of these common southern Oaks have been recorded by Professor E. W. Berry as occurring in the Pleistocene of the Atlantic coast, and I have

myself found fruit and leaves of *Quercus nigra* in deposits of the same period near Palestine in eastern Texas. And while the little known *Quercus arkansana* has not as yet been recorded in a fossil state its characters and the circumstances of its distribution suggests the possibility at least that it may be a surviving representative of an ancient form perhaps ancestral to both of its nearest living allies. Somewhat similar is the case with regard to the Nutmeg Hickory (*Carya myristicaeformis* Nutt.), which, as mentioned by Professor Sargent (Botanical Gazette, LXVI, 233), is the only living species connecting two quite distinct sections of the Hickories. Its comparative rarity and peculiar distribution would also indicate that it is an ancient and disappearing species that may formerly have been much more abundant. It is of course quite impossible now to trace except in the most general way the complex succession of influences that resulted in the present composition and distribution of our forests. In their earlier stages they were probably profoundly affected by the advance and retreat of the glaciers, or by oreogenic movements with consequent changes in drainage systems or the obliteration of great inland bodies of water, or by the appearance or severance of land connections or barriers, any of which might result in profound climatic changes. In response to these influences the movements of advance or retreat would proceed until they become inoperative or perhaps were reversed by some new development. In the progress of such movements, especially along lines of retreat, many stragglers and small colonies would be scattered and make stands in spots particularly favored by topography, soil or other local conditions, and as the turning point was approached these would naturally have become more numerous. In the course of such fluctuations cross currents must often have met and so brought together diverse elements from widely separated sources.

In localities like the one we are considering, in the Red River valley near Fulton, Arkansas, there seems to be evidence that something of this sort has taken place. Indeed such shiftings and minglings have doubtless occurred many times in all parts of the forest area, the only difference being that in certain places the effect was more marked and the evidence has been better preserved. Among the influences that we may recognize at present as accounting for the richness and diversity of the flora and the preservation of a number of unusual species in this locality are the proximity of the great river and the character and position of its valley, lying as it does just south of the semi-mountainous Ozark region; the diversity of drainage conditions and soils, and especially the presence of the light marly sands and the rather peculiar ridge and ravine topography developed in this formation. Just what, however, were the influences or sequence of events that account for the bringing together of this rather remarkable collection of ligneous plants in so small a space it is also impossible to determine. In its earlier stages it was doubtless involved with those great

continental movements late in the Tertiary that elevated the western lands and sent down the floods that spread the Lafayette gravels across the Gulf States from the base of the Rocky Mountains to the Mississippi River, that elevated the Ozark plateau and Boston Mountains on the north and drove the waters of the Gulf far to the south before the advancing plain. At any rate it seems evident that in places like this we may recognize the approximate lines along which some of these fluctuations of the ancient forest culminated. So that the investigator here may feel an emotion somewhat like that of a traveller standing on some famous historic spot which brings him face to face with the past. Only here he may be sure he is dealing with events that far transcend the dates of all human history, and the silent forest yet stands as a living link between the present and the past.

THE RHODODENDRONS OF NORTHEASTERN ASIA
EXCLUSIVE OF THOSE BELONGING TO THE
SUBGENUS ANTHODENDRON

ERNEST H. WILSON

THE Rhododendrons dealt with here are found scattered over an immense territory from the Altai Mountains in about Long. 90° E. eastward to the Pacific Ocean in Long. 145° E.; in latitude from about 60° N. to 30° N. One species (*R. kamtschaticum* Pall.) extends through the Aleutian Islands to Alaska and finds the southern limit of its distribution on Banks Island in British Columbia. Three of the species (*R. Metternichii* S. & Z., *R. Keiskei* Miq. and *R. semibarbatum* Maxim.) are purely Japanese. One (*R. brachycarpum* D. Don) is Japanese and Korean; another (*R. micranthum* Turcz.) extends from Korea through south Manchuria, south Mongolia and northern to western China and has its southern limit of distribution on the mountains of Hupeh province and its western on that of Szech'uan on the Chino-Thibetan border-land. The other species are very wide-spread in northeastern Asia though *R. Adamsii* Rehd. seems to be limited to east-central Siberia and more especially to the mountains of the Baikal region and the valley of the Lena River. One might expect to find a greater number of species in so vast a territory but it should be remembered that as a rule in boreal regions species are few and widely distributed. In Japan especially one would have thought that a more intimate knowledge of the rich flora would have revealed additional species of Rhododendron than were known to Maximowicz in 1870. It is true that Japanese botanists have described one or two species but I do not think these can be maintained.

In his work on the Rhododendrons of eastern Asia, Maximowicz enumerates 31 species indigenous in that region. Of these 17 species are what are popularly known as Azaleas and have been described by